FORMED: 5286860

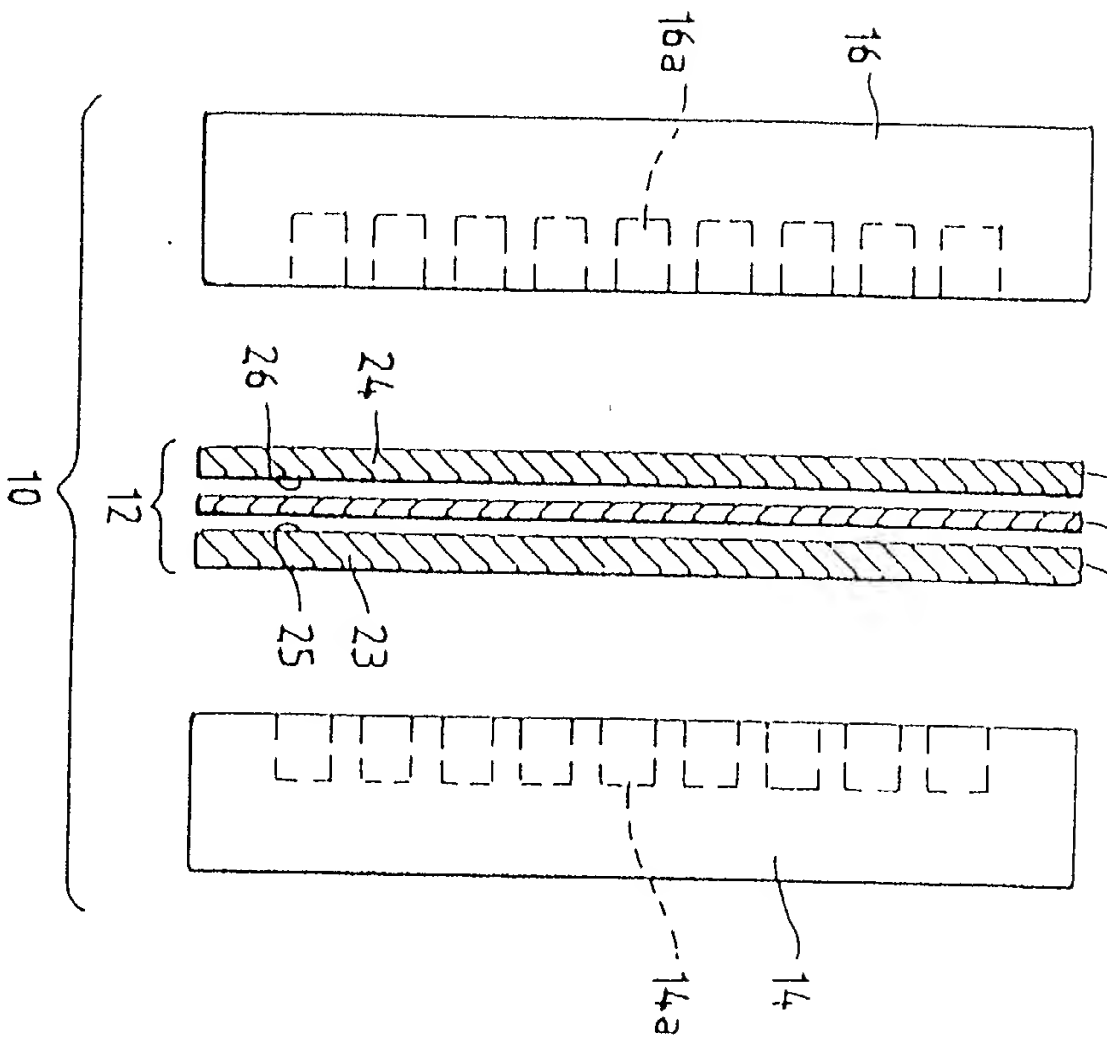


FIG. 1

FIG. 2

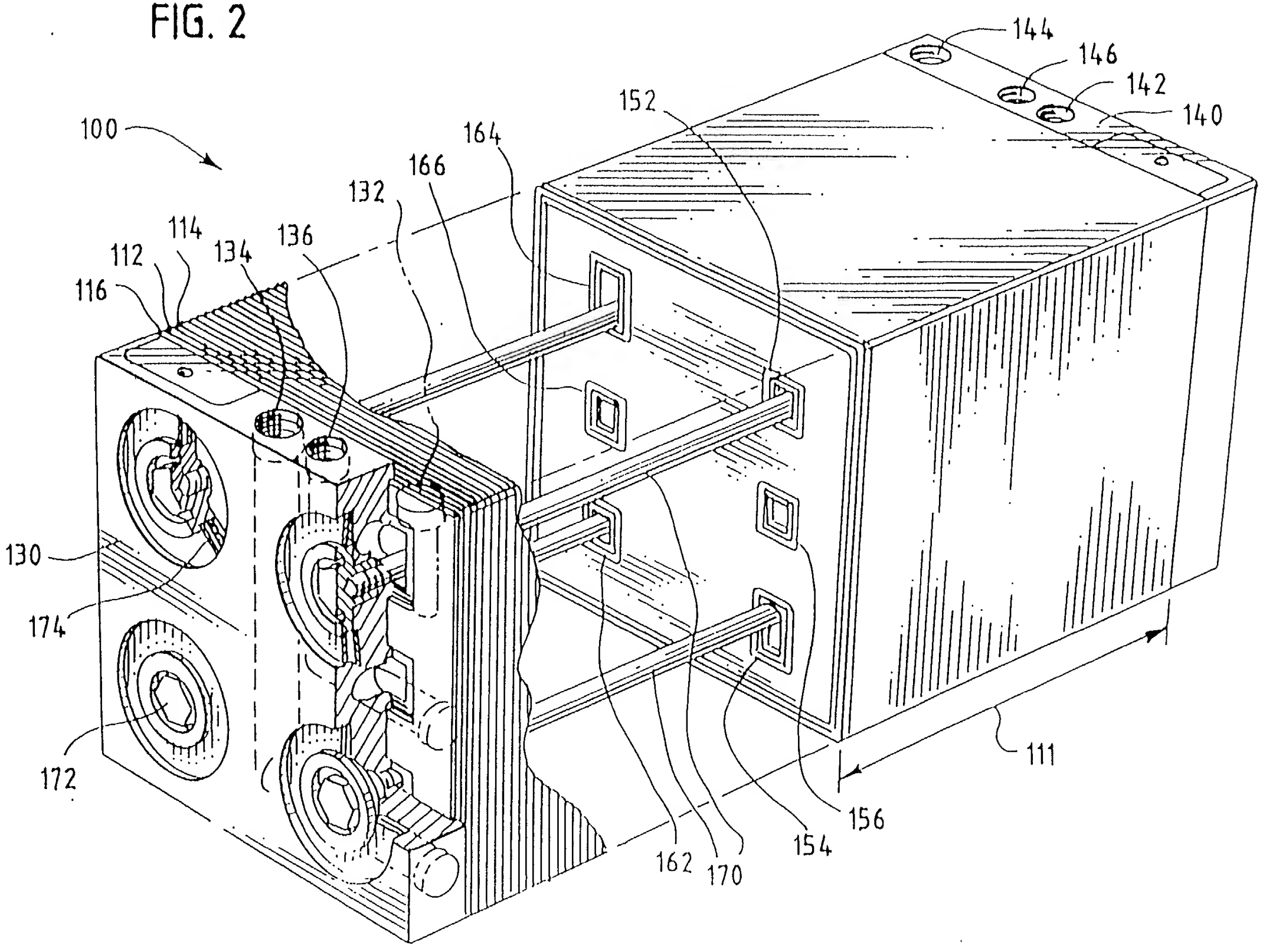

100
116
112
114
134
136
132
166
164
152
144
146
142
140
130
174
172
111
156
154
170
162

FIG. 3

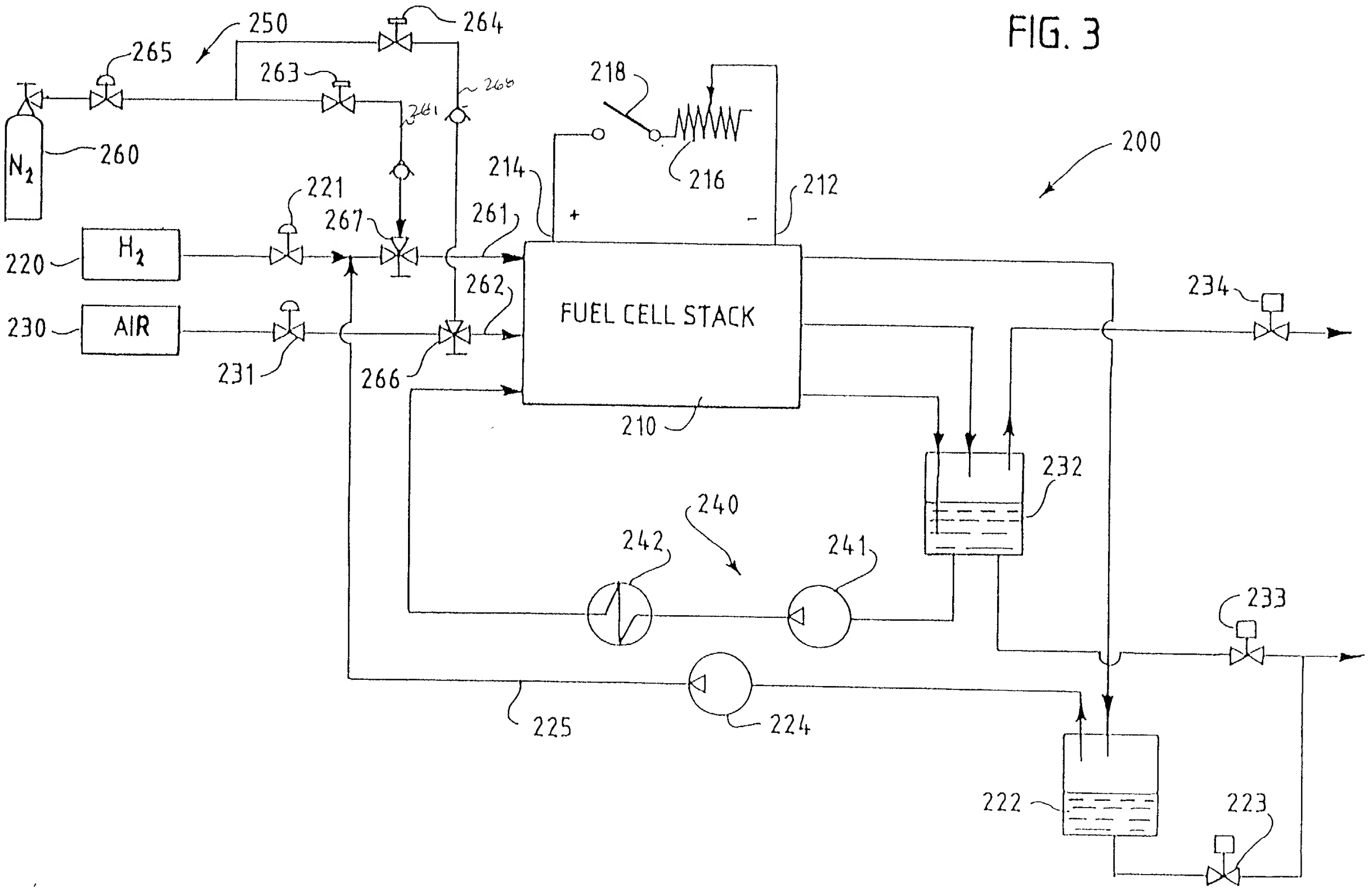
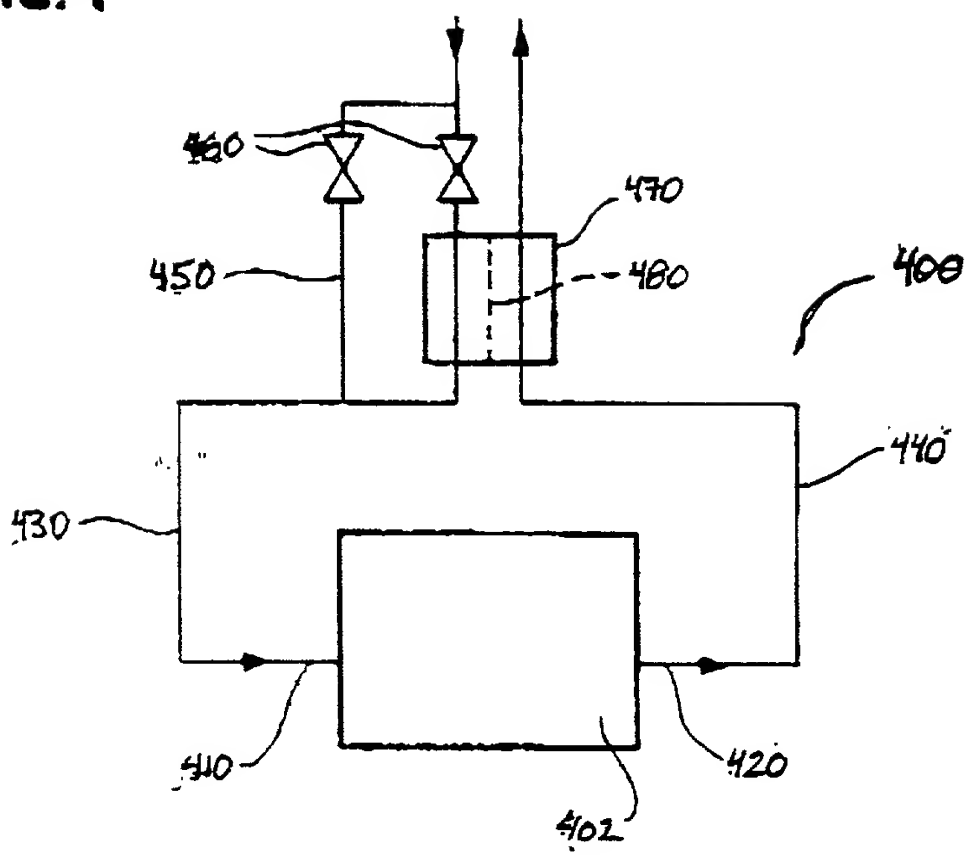

250
264
265
263
266
261
N_2
260
218
200
214
216
212
221
267
261
220
H_2
262
FUEL CELL STACK
234
230
AIR
231
266
210
232
240
242
241
233
225
224
222
223

FIG.4



TOSZEO" 5,286,860

FIG. 5

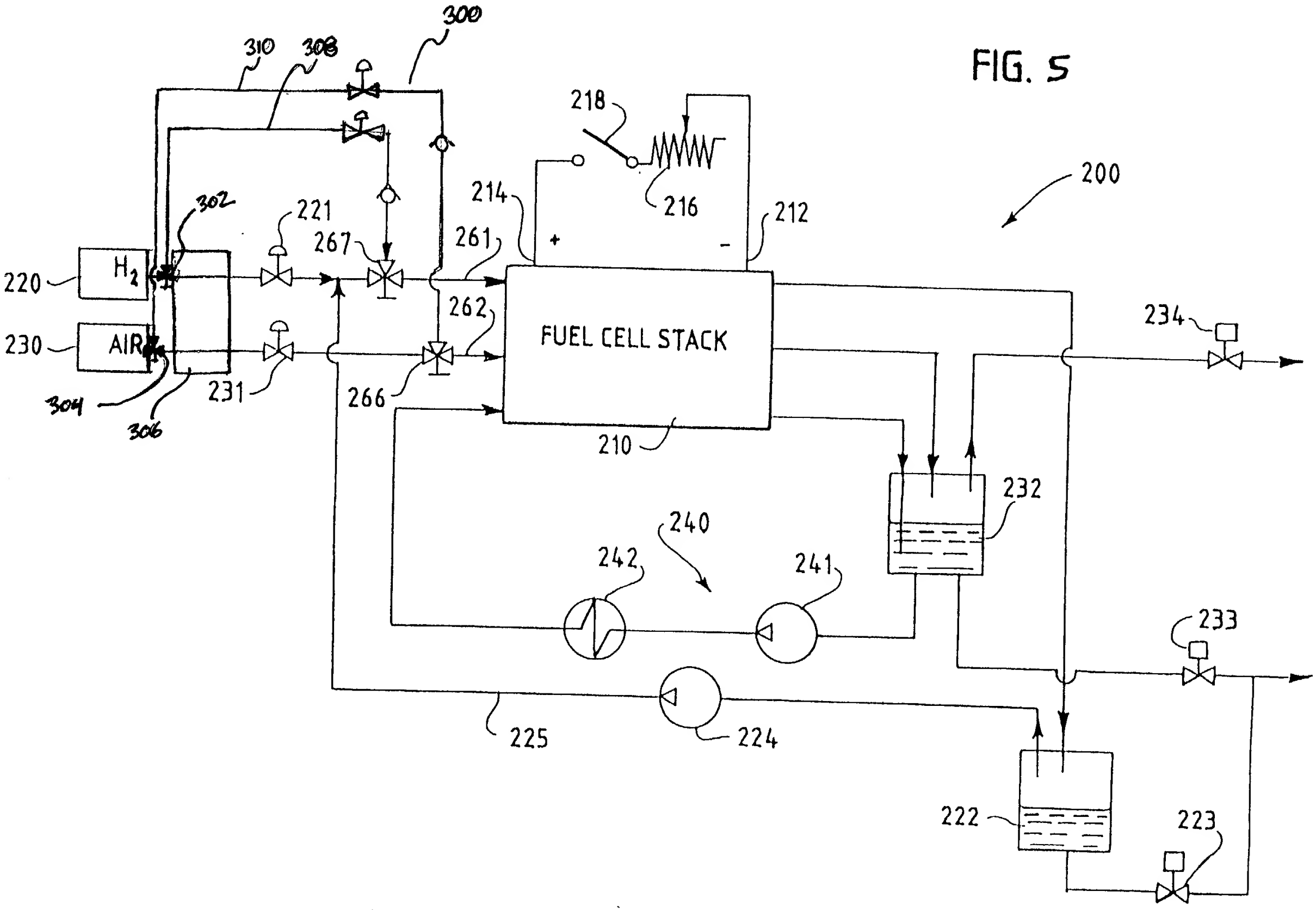


FIG. 6

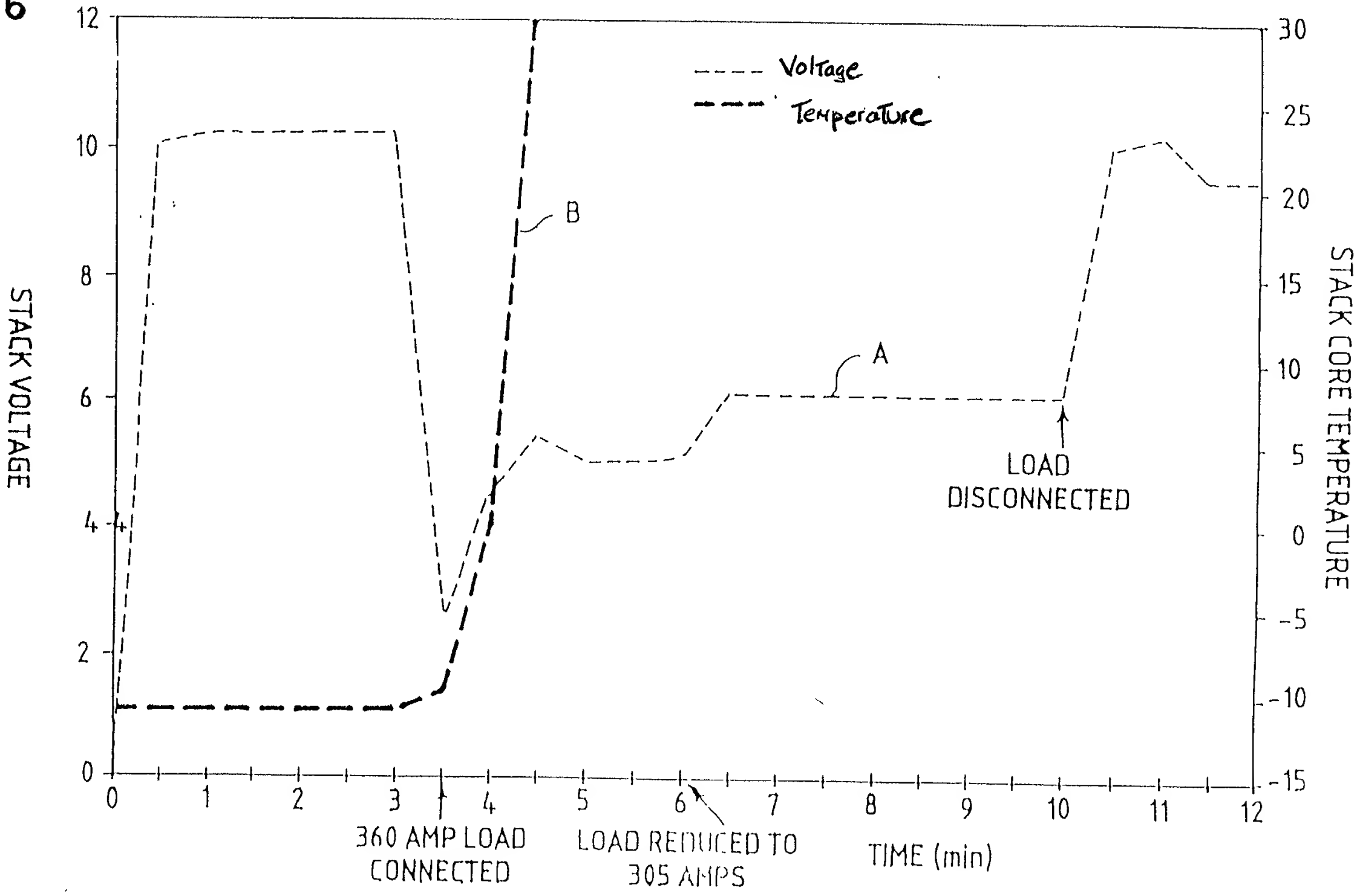
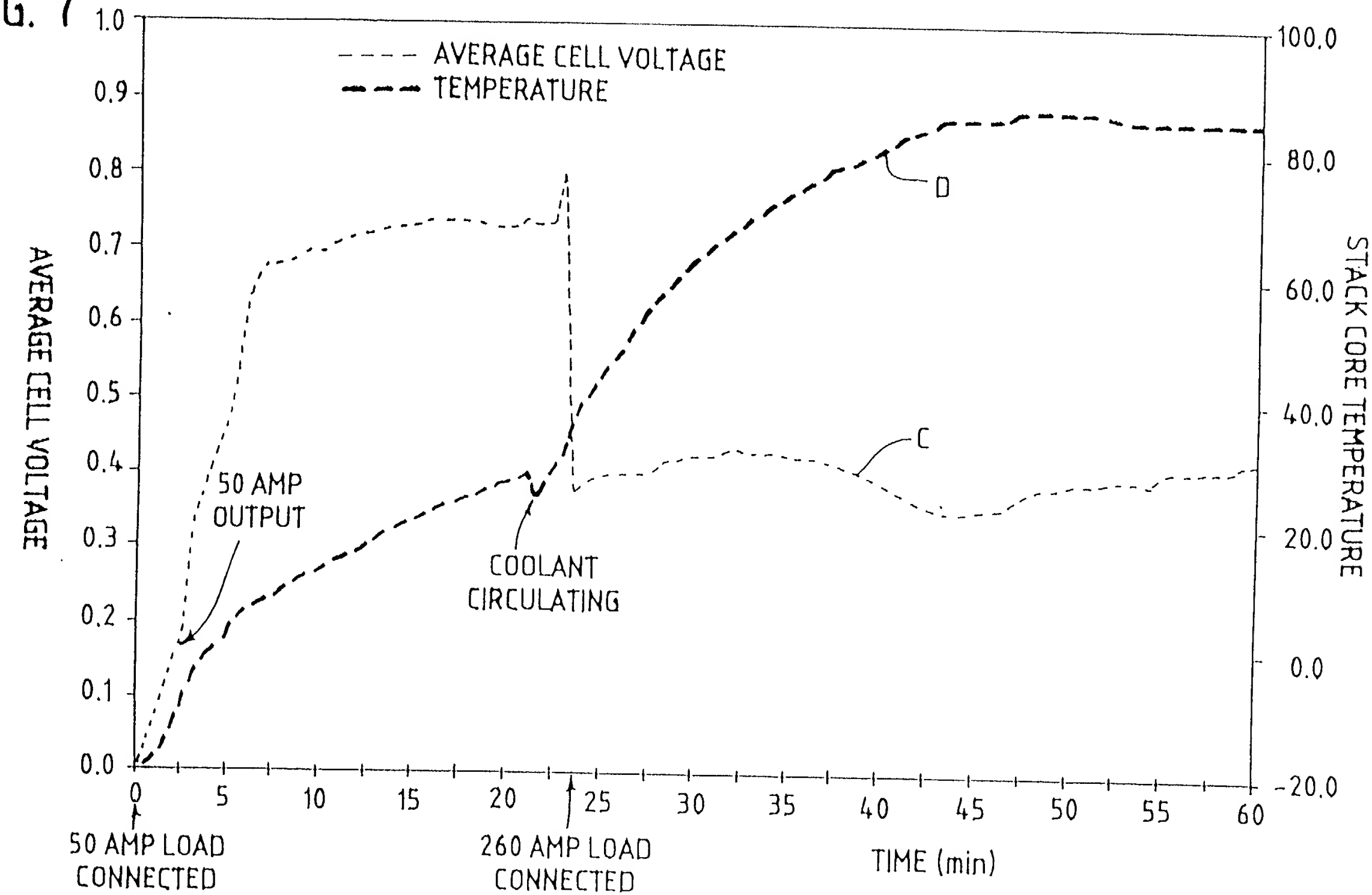

Voltage
Temperature
B
A
LOAD
DISCONNECTED
STACK VOLTAGE
STACK CORE TEMPERATURE
TIME (min)
360 AMP LOAD
CONNECTED
LOAD REDUCED TO
305 AMPS
0
1
2
3
4
5
6
7
8
9
10
11
12
0
2
4
6
8
10
12
-15
-10
-5
0
5
10
15
20
25
30

FIG. 7


AVERAGE CELL VOLTAGE
TEMPERATURE
AVERAGE CELL VOLTAGE
STACK CORE TEMPERATURE
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
0
5
10
15
20
25
30
35
40
45
50
55
60
TIME (min)
D
C
50 AMP
OUTPUT
COOLANT
CIRCULATING
50 AMP LOAD
CONNECTED
260 AMP LOAD
CONNECTED

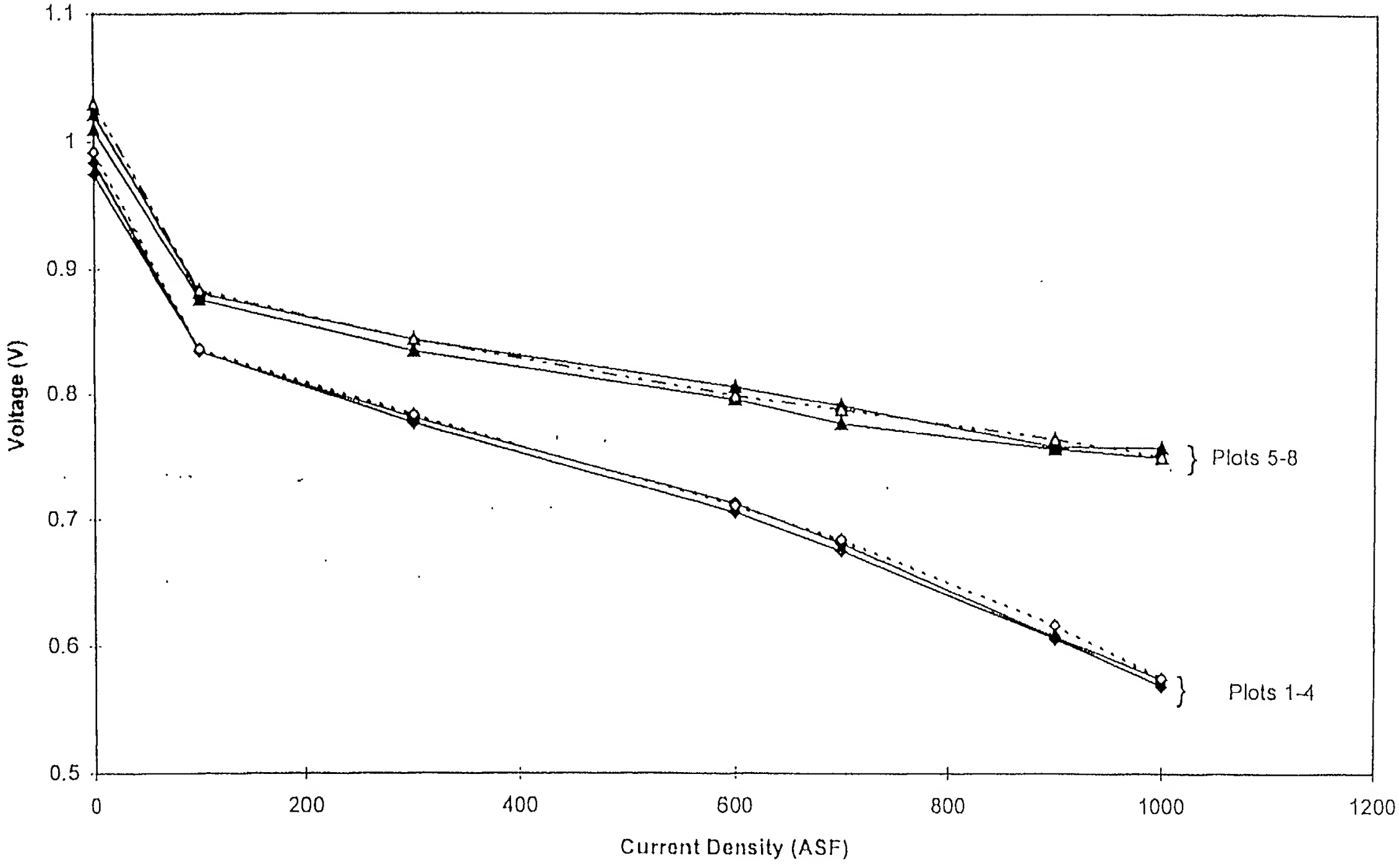

1.1
1
0.9
0.8
0.7
0.6
0.5
Voltage (V)
0
200
400
600
800
1000
1200
Current Density (ASF)
Plots 5-8
Plots 1-4

FIGURE 8

FORMED SHEET

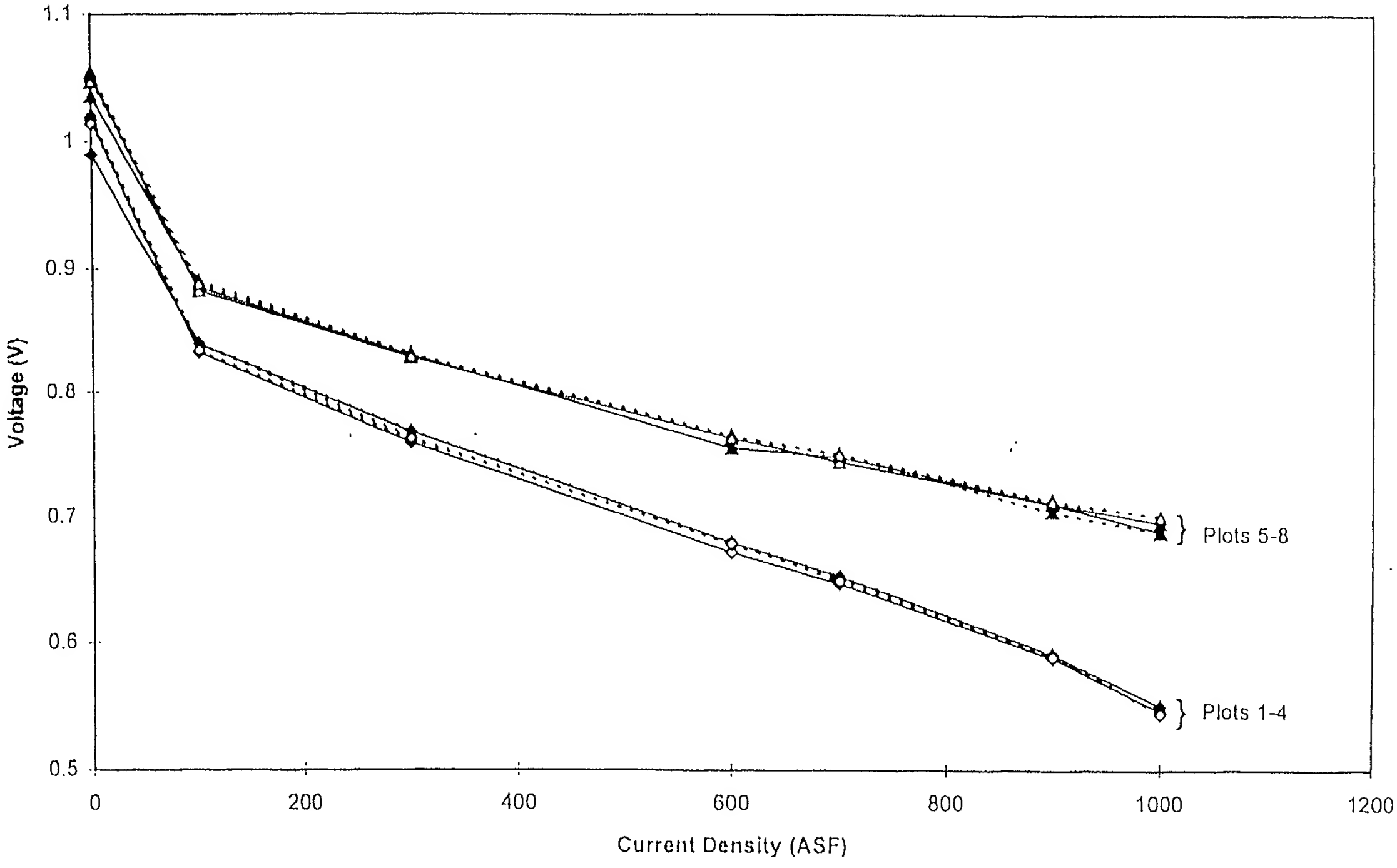


FIGURE 9

FOBECO 5268860

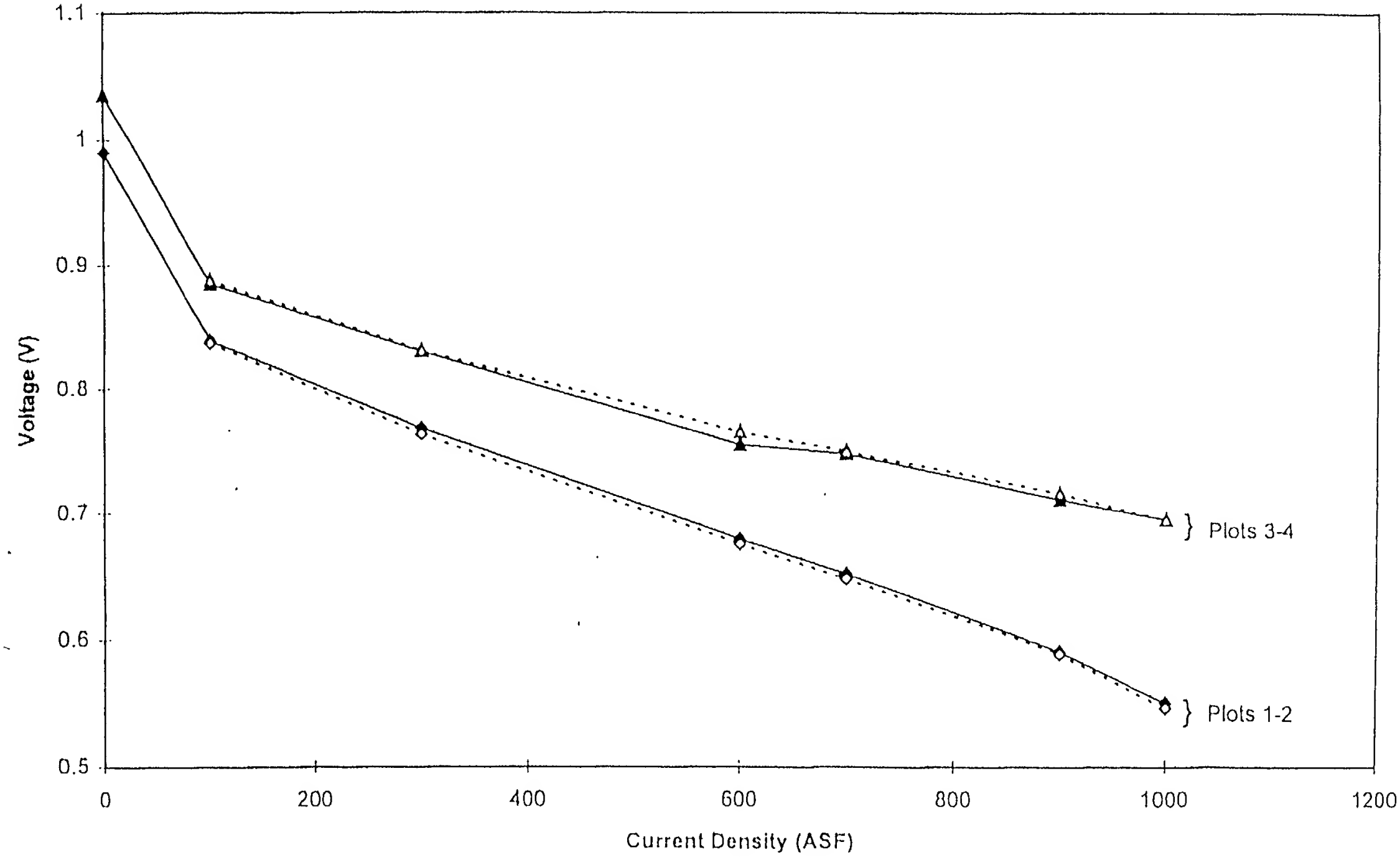


FIGURE 10

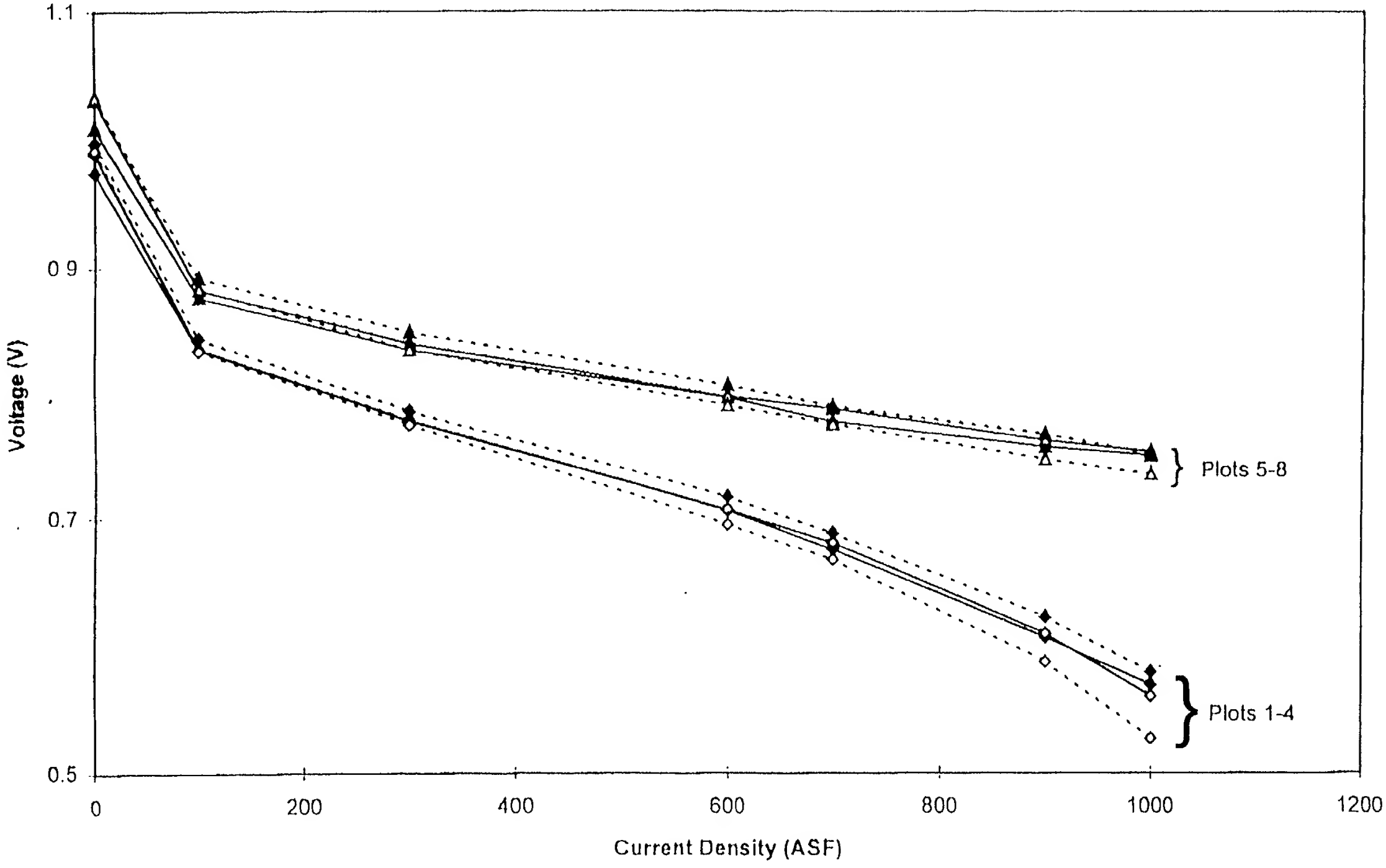

1.1
0.9
0.7
0.5
Voltage (V)
0
200
400
600
800
1000
1200
Current Density (ASF)
Plots 5-8
Plots 1-4

FIGURE 11

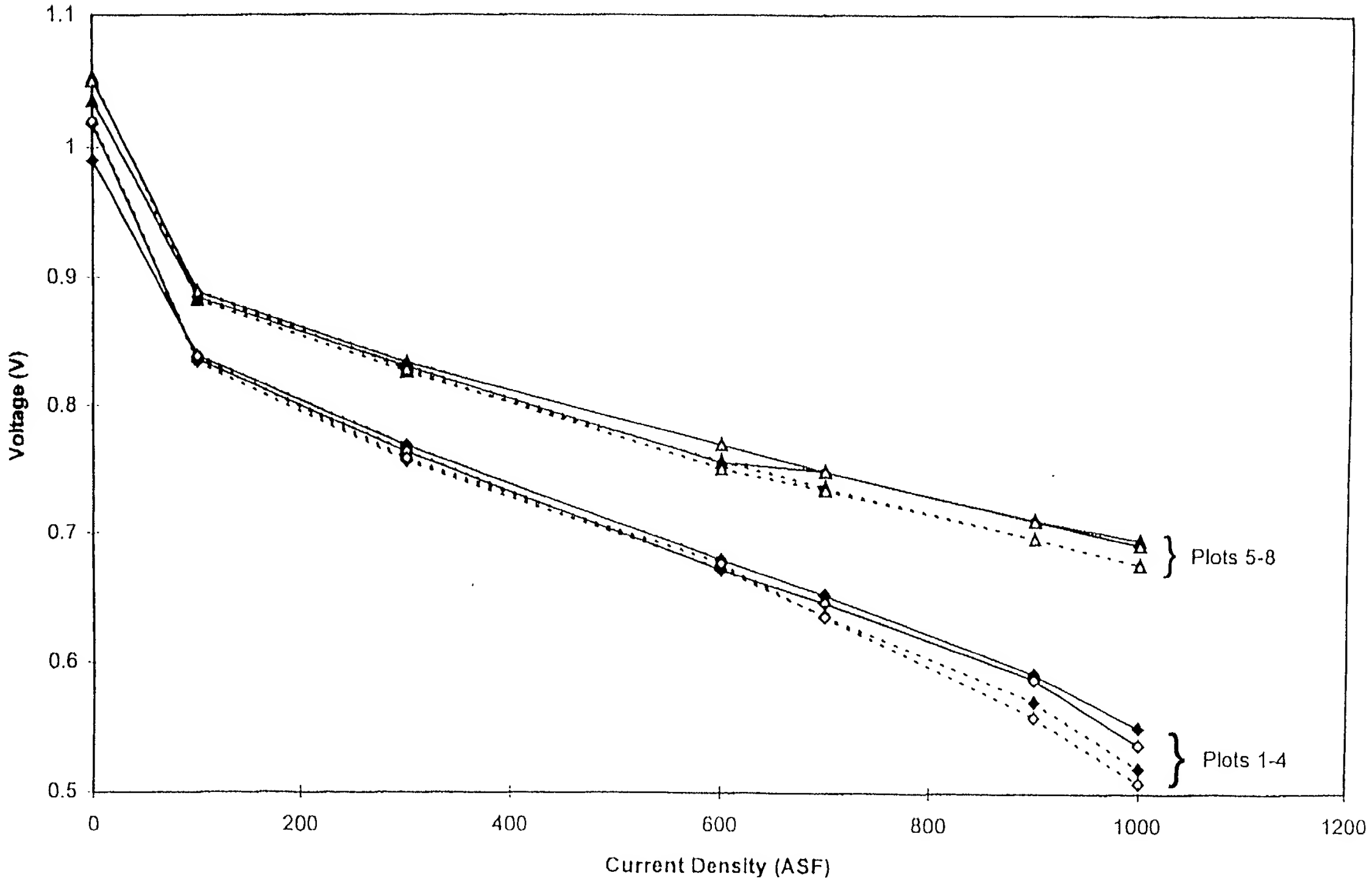

1.1
1
0.9
0.8
0.7
0.6
0.5
Voltage (V)
0
200
400
600
800
1000
1200
Current Density (ASF)
Plots 5-8
Plots 1-4

FIGURE 12

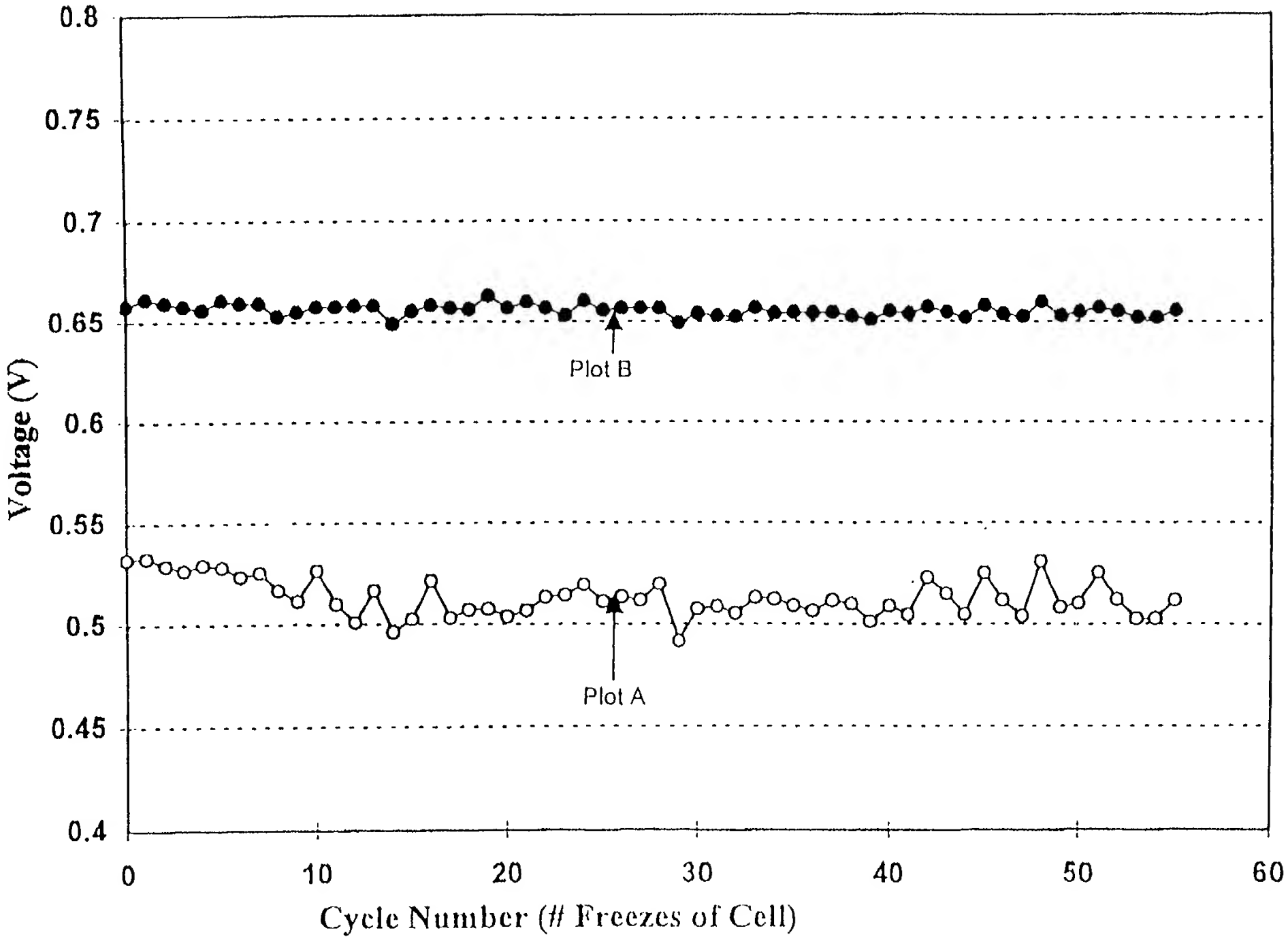

0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
Voltage (V)
Plot B
Plot A
0
10
20
30
40
50
60
Cycle Number (# Freezes of Cell)

FIGURE 13

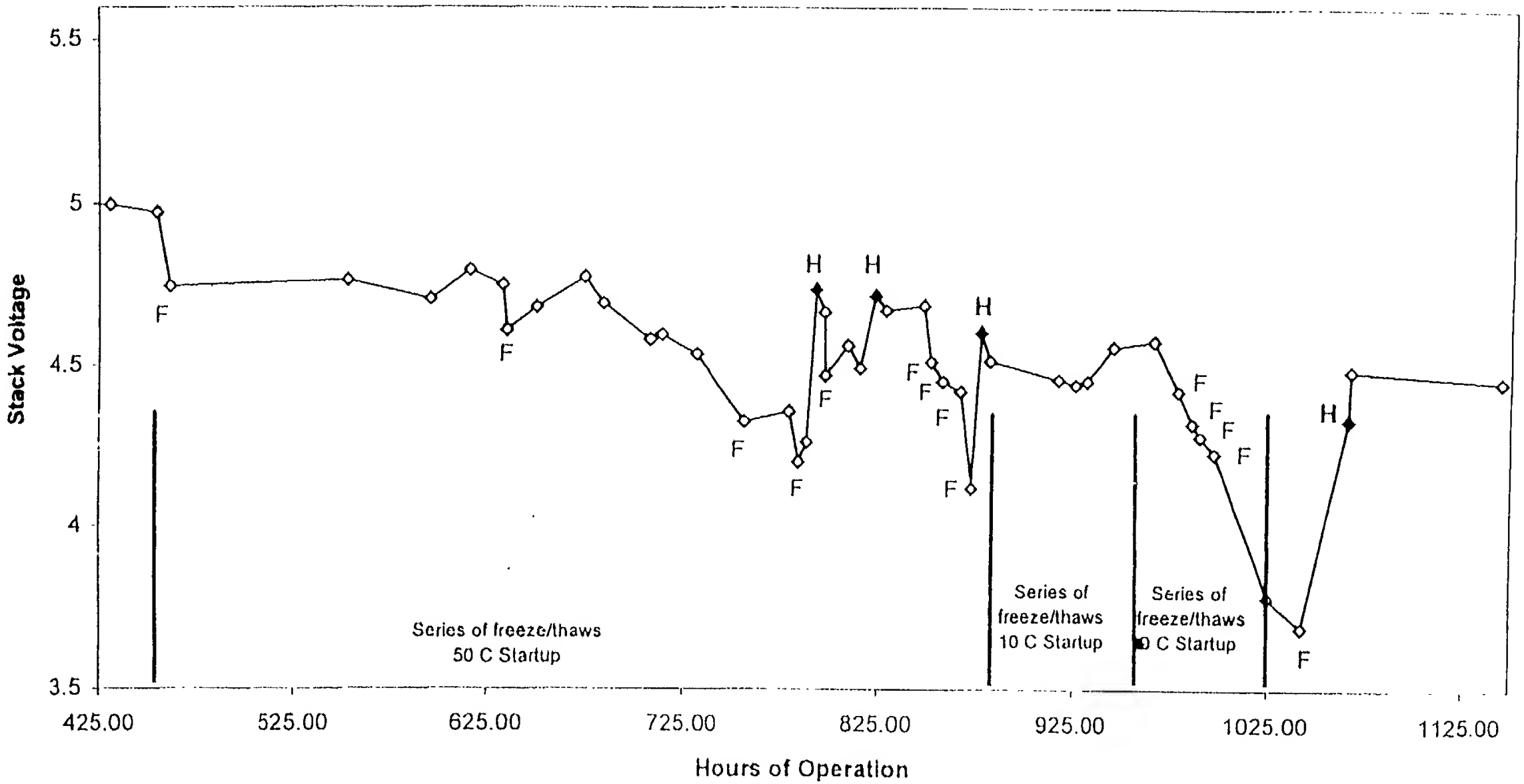

5.5
5
4.5
4
3.5
Stack Voltage
425.00
525.00
625.00
725.00
825.00
925.00
1025.00
1125.00
Hours of Operation
Series of freeze/thaws
50 C Startup
Series of
freeze/thaws
10 C Startup
Series of
freeze/thaws
0 C Startup
F
H

FIGURE 14

FORMED: 5,286,360

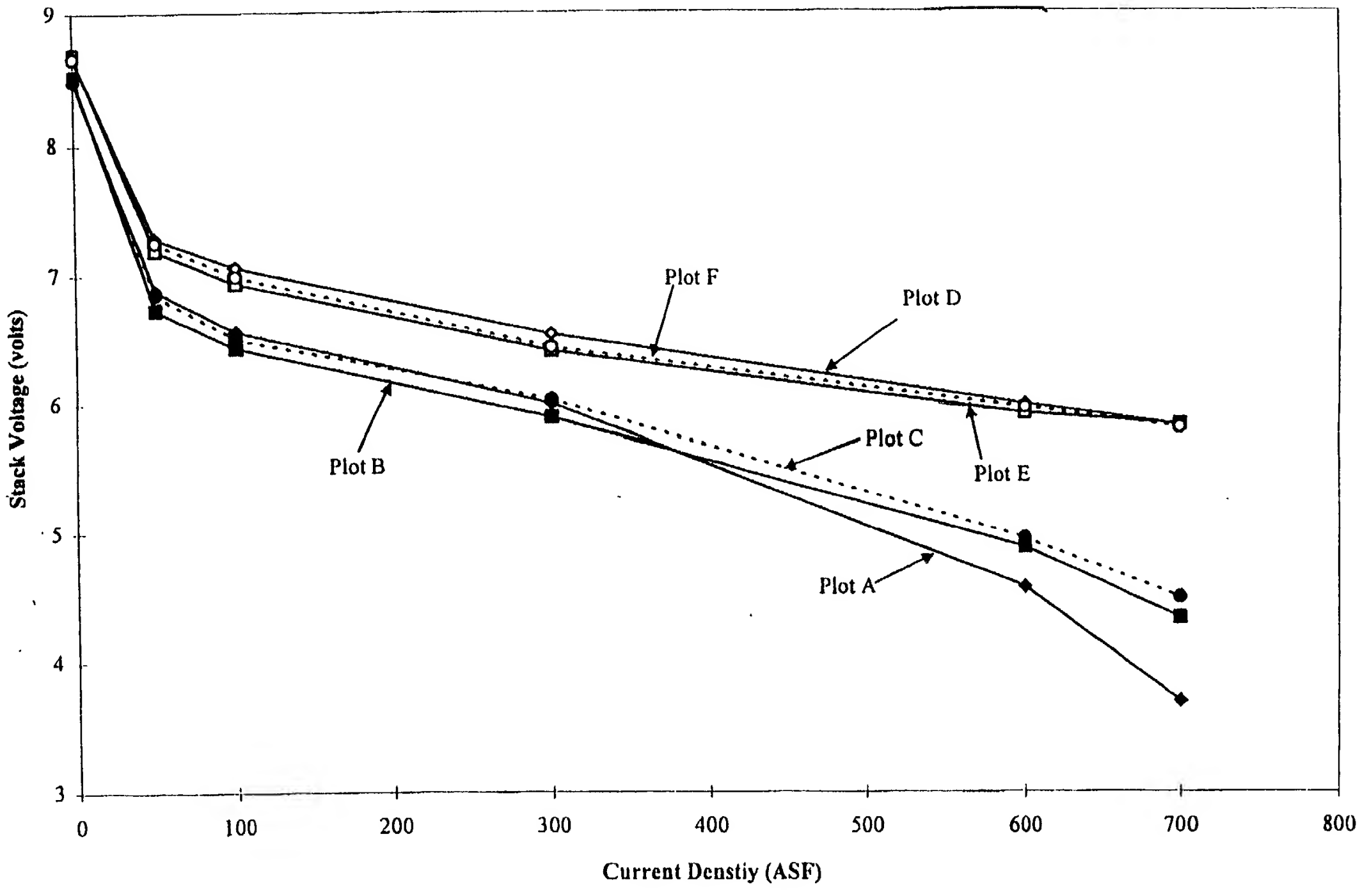


FIGURE 15